
One-to-One Computing in Maine
A STATE PROFILE

PRELIMINARY REPORT
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Executive Summary

Angus King put Maine on the map as the first state in the nation to provide all 7th and 8th grade students—and their teachers—with a laptop computer and wireless access to the Internet.

How did this happen in Maine? The initiative began with a Governor (Angus King), looking for a way to ensure economic viability for Maine in the 21st Century; a visionary (Seymour Papert, MIT professor and Maine resident), who was extremely persuasive about the power of ubiquitous computing; a State Legislature, willing to openly research the idea; and an education community, primed to team up with creative partners (Apple Computer, state universities, and the Gates Foundation) to bring the idea to scale with quality.

What exactly did policymakers expect to accomplish by investing in such a radical idea? Three things drove the decision: increased economic viability for the state, higher levels of academic achievement, and a desire to close the digital divide. Still, the idea set off a firestorm of public debate. As popular as Governor King was at the time, it took a lot of political capital to pull off a program of this size and scope. With few exceptions, most opponents were not against providing Maine middle school students with one-to-one access; they instead were advocates of alternate uses for the multimillion dollars in excess revenue that would be used to fund it.

After initially stalling during the 2000 Legislative session, the idea went to committee to be studied for a year. The tipping point for the Maine Learning Technology Task Force, as the group came to be known, was “seeing” the engagement and motivation of students in pilot schools with laptops, as well as the idea that effective use of one-to-one could be both an equalizer and a bridge to higher academic achievement.

By the time the idea was funded in 2001, an economic downturn had threatened its financial support, and the federal No Child Left Behind had shifted the spotlight to high stakes accountability in the basics and away from technology literacy and the development of 21st century skills. Officially, the Maine project is still in precarious waters. Sustainable funding has not been secured long-term, and schools are unsure of whether these students, as high school freshman, will have ongoing access to the technologies and educational opportunities to which they have now become accustomed.

“My job as a leader is to try to look out into the future, see what's necessary and then equip my people with whatever it is. This proposal is for every school, every kid, rich, poor, north, south, east, west, rural and urban.”

-Governor Angus King

Expected Return on Investment from Ubiquitous Computing in Schools:

- Increased economic viability for graduates and for the state
- Higher academic achievement
- Digital equity

“One-to-one computer access changes everything. But let me make this crystal clear: This is not about technology or software, it is about teaching kids.”

-Bette Manchester, Maine Distinguished Educator

But the reality in Maine presents a different picture. The laptop initiative has breathed new life into learning in the state's middle schools, and students and teachers alike are more fully engaged in relevant, meaningful teaching and learning. Educators have formed collegial circles of learning even as they struggle to make sense of these high tech learning tools. Business and industry see the potential for building a high-tech, educated workforce in the state; parents believe the program provides a solid, 21st century foundation for their children's futures.

One-to-one computing in Maine has been a catalyst for change on a number of levels, from the classroom to the boardroom. In the program's first two years, Maine has attracted national attention, resulting in new economic investment and awards of federal education grants to this remote state.

While the jury is officially still out in terms of the impact ubiquitous computing has had on learning and economic viability, it seems clear that in Maine middle schools the digital divide is closing and the laptops are here to stay.

Unanticipated Results:

- Students are becoming respectful, responsible "ambassadors" of the program
- Teacher skepticism is down – and student retention is up
- Parent-student communication is improving

"This initiative provides all sorts of unseen advantages.... Most satisfying of all, these students will grow up with the knowledge that they were trailblazers – the first large-scale group in the nation to use this new tool for learning."

-Maine Middle School Principal

Maine Learns - Quick Facts:

Date of Implementation:

Demonstration/Exploration (Pilot) Program:
2001-2002 school year

Year 1 Full Implementation (7th grade and demo sites only): 2002-2003 school year

Full Implementation: 2003-2004 school year

Students Currently Involved: 33,000 7th and 8th graders statewide

Teachers Currently Involved: 3,000 teachers

Number of Schools: 243 schools statewide

Technology Used: Apple iBooks, AirPort wireless

Actual Cost: \$37.2 million

Remaining Challenges:

- Sustainability
- Assessment of impact beyond test scores
- Rate of capacity-building for educators to leverage the investment
- Ability of the state to retain students in New Economy jobs

1. Why did educational policymakers in Maine focus on ubiquitous computing for 7th and 8th graders?

"I want our kids to be the most computer literate, digitally competent group of young people in the world...where the use of the technology is second nature."

--Governor Angus King, *Wired Magazine*, August 24, 2001

State level policymakers in Maine identified three key factors that influenced their decision to pursue a one-to-one computing initiative:

- Economic viability
- Closing the digital divide
- Higher academic achievement

Vision:

In Maine, the bottom line for implementing this innovative ubiquitous computing program was vision: the state's policymakers sought to put Maine on the map by becoming the first to go one-to-one. With that in mind, and intending to breathe new life into Maine's economy through unprecedented educational opportunity for all students, Maine's Governor, Legislature, and the Maine Learning Technology Endowment (MLTE) Task Force concluded that: *"Others have tinkered...but Maine can be first. First to recognize, as a state, the enormous potential of learning technology, and first to act boldly to prepare our schools and students to meet this challenging change."*

Business leaders in the state had just released an action agenda based on work from the National Governors' Association that linked economic viability to quality of life. Furthermore, the *30/1000 Report*, by the State Planning Office, had set a target for attracting and developing information technology companies to the state. The target translated into 30% of Maine's population holding 4-year degrees, and \$1,000 per employed worker invested in research and development.

"As I talk to businesses, the biggest thing that they look for is qualified people...We've got a lot of small towns, a lot of people whose parents didn't go to college and a relatively low number—about 20 percent—of our people have college degrees."

"My job as a leader is to try to look out into the future, see what's necessary and then equip my people with whatever it is. This proposal is for every school, every kid, rich, poor, north, south, east, west, rural and urban. At a stroke, it would begin the elimination of the division between the technological haves and the have-nots."

—Governor Angus King, *Darwin Magazine*, August 2000

Advocacy and Justification:

Governor King returned from that National Governors' Association Conference with the idea of investing in Maine's economic viability through improved student-to-computer ratios. Seymour Papert, a renowned expert in the field of learning and technology, had been masterful in convincing him that one-to-one computing was not only the solution the Governor was looking for, it was itself economically viable. Of course, it helped that the state had an unanticipated \$50 million in revenue from a tobacco settlement to invest in this grand vision.

Still, Governor King's one-to-one computing initiative – which proposed that \$65 million (\$50 million of state money and an anticipated \$15 million in private contributions) be used to establish an interest-generating endowment that could fund the program in perpetuity – touched off a firestorm of public debate in Maine. Many citizens felt that the Governor had lost his bearings and that the money would be better spent on school facilities, low-cost prescription drug benefits for the state's many seniors, road improvements, and other programs.

The debate grew so intense that the Maine Legislature refused to authorize the state funds for the endowment. Instead, the initiative was sent to a Task Force for a year-long review prior to reconsideration by the Legislature (P. L. 1999, Chapter 731, Part FFF, Sec. FFF-2: Task Force on the Maine Learning Technology Endowment). The Task Force considered data from a variety of sources, including: summaries of Maine educational technology initiatives to date; demonstrations of best practices; 'test drives' with laptops; results from two statewide surveys on instructional technology in Maine; public testimony of Maine citizens; a review of nationally recognized projects such as the one in Henrico County, Virginia; and analyses of economic opportunities and challenges as outlined by spokespersons from the economic development agencies, the State Planning Office, and Maine technology innovators.

The turning point for most members of the Task Force, especially those from the State Superintendent's office, was the discovery of a renewed interest and engagement in school by students participating in one-to-one programs – a finding they believed would translate into increased educational attainment. From that point on, the Maine Learning Technology Initiative (now known simply as Maine Learns) focused on *“making learning more dynamic, engaging, and personalized, and extending learning well beyond the school walls.”*

Barriers:

The arguments against ubiquitous computing in Maine, as mentioned above, were generally arguments *for* alternate uses of the \$50 million in unanticipated General Fund monies. In fact, a less popular Governor might not have been successful in advocating for one-to-one; the link between laptops for middle schools and economic viability is a stretch for many citizens. But Governor King successfully used his extensive political capital to influence key groups into seeing possibilities that were not immediately obvious to others. In the end, even he was able to get the idea only so far – into consideration by the Task Force. After that, it was the merit of the program that transformed detractors into advocates, including those who were staunchly opposed at first, such as Task Force Chairman and Representative Michael Brennan. It helped that other Task Force members, such as former school principal and Distinguished Educator Bette Manchester, could assist in bringing the practicality and learning potential of ubiquitous computing to light. *“One-to-one computer access changes everything,” she says. “But let me make this crystal clear: This is not about technology or software, it is about teaching kids.”*

Impetus at the School and District Levels:

At the school and district levels, economic viability was also cited as a key driver in the laptop program; skepticism over whether increased access would truly result in an economic advantage for the state was a point of contention as well – especially in rural communities like Pembroke. Everyone wanted to keep the most qualified students from leaving and attract businesses to Maine, but it took putting the Governor’s vision into practice to convince some stakeholders it was sound. Still, not one school or district – even Freeport, which was part of the general rollout and not a demonstration site – indicated that the impetus for one-to-one had come as a mandate from above. If anything, the state’s consideration of the laptop initiative encouraged schools and districts to provide whatever evidence they could that it was a good idea. Initially, at least, the state’s primary influence came in the form of leadership, vision, and support. Later, real and perceived discrepancies over how best to measure gains would also become a factor (see below).

Nevertheless, specific reasons for adopting a ubiquitous computing policy most often cited by school and district leaders were:

- Economic viability for individuals and for the state
- The potential for improved teaching and learning that is more in line with 21st century skills – especially real-world relevance, higher-order thinking and problem solving, information literacy, and effective communication
- Closing the digital divide and leveling the playing field
- The “opportunity” such an initiative provides for schools and districts to explore new sources of funding

Research, Policy Studies, and Advocacy Documents Used:

Most educational leaders in Maine had at least read about other schools and districts (particularly Henrico Co., VA) where one-to-one environments had already been implemented, and some paid such districts visits. Piscataquis Community Middle School (having had a one-to-one program in place since 1999) also served as a good model for others in the state, including Governor King. Almost all considered some outside research studies and evidence as part of their decision to implement one-to-one – particularly those that had applied to be demonstration sites.

Arguments or Evidence Against One-to-One:

As was the case at the state level, the laptop program was not without its skeptics in some schools, districts, and communities. Though most detractors have since “come around,” a few remain unconvinced. Most interviewees attribute such attitudes to a lack of real hands-on knowledge about the program. Crystal Priest, the District Technology Coordinator in Guilford (SAD #4), spoke about the slew of emails received by Governor King in opposition to the program. One email asked, *“If you want to give them real-world skills, why not give every kid a chainsaw instead?”* King responded by saying, *“Chainsaws top out at \$20 an hour. Technology tops out at Bill Gates.”* Priest found that similar explanations worked to convince others as well.

Chris Toy, principal of Freeport Middle School, put it this way: *“To judge the laptop program on the anecdotes of ‘teachers don’t know how to use the laptops, kids are playing games, and we can’t afford it’ is to do a disservice to this fledgling program. Most people don’t know how to use computers as well as they should, but that doesn’t mean they shouldn’t be implemented (how many*

of us know how to program our VCR?). Learning tools are no longer linear, so once you take a 3D tool like a PC and let people have at it, there's no telling what they'll figure out. In our experience, teachers are also good learners, so we suspect they can figure it out pretty quickly."

There was also some opposition on behalf of the teachers – though not necessarily *from* the teachers themselves. There was some concern among stakeholders that the technology would mean simply “*adding another thing.*”

A final argument against the initiative – mentioned several times at this level – centered on its political presentation. As a way to decide how to spend the \$50 million in settlement money, the state had essentially presented its citizens with two options: laptops or prescription drugs. Maine has a large population of seniors, and the “either/or” choice was a difficult one to make.

2. What trends are emerging in national, state, and local policies that impact ubiquitous computing in Maine?

National Trends:

According to state policymakers in Maine, there are five national trends that impact ubiquitous computing in the state:

- High-stakes accountability
- Lack of student access to technology
- Budget cuts in education
- Standards-based learning
- Renewed focus on highly-qualified teachers

High-Stakes Accountability:

The emergence of the No Child Left Behind legislation and its emphasis on high-stakes accountability actually serves as a detractor from ubiquitous computing goals in Maine. Dr. David Silvernail, the evaluator for the laptop initiative, bluntly stated that, “*NCLB is about accountability, not teaching and learning...If all we were doing was responding to NCLB, we would not be engaged in ubiquitous computing.*”

Most schools and districts interviewed said that improved academic achievement, as measured by standardized tests, was an important consideration, but not the *most* important. Many thought there was already too much emphasis on quantifiable, high-stakes data, and they wanted to see more thought given to measuring intangibles like increased student engagement and the development of skills such as critical thinking, problem solving, and research.

PCMS example:

Matthew Oliver, Superintendent of SAD #4, had perhaps the most straightforward response regarding the issue of NCLB legislation: “*I’m just ignoring it. We promote high student achievement for our reasons, not the Feds’, and we’ll exceed the requirements of NCLB by doing that.*”

Technological literacy, for example, is measured, but “*we don’t teach technology, we integrate it.*” The computer is “*just a box that can be a really useful tool*” – if the focus is right.

Student Access:

The initial report from the Maine Learning Technology Endowment Task Force found that teachers were using technology effectively, but that students in Maine had been averaging such minimal access that this use was having no effect on their learning. Without sufficient access, the Task Force concluded, the potential of any technology investment cannot be fully leveraged.

Budget Cuts:

Across the nation, the tremendous cuts in education funding due to the current economic downturn have caused policymakers to more closely scrutinize their technology investments. As a result, educators are being asked to demonstrate a return on the state's investment (this was the point of the initial MLTE Task Force report) and report on interim gains. In Maine, the latter was accomplished through interim reports to the State Legislature: first in January and again in March of 2003, the former just 6 months after the one-to-one program's launch. That preliminary data focused mainly on student engagement and student, teacher, and parent satisfaction, since the "jury" was still out on student achievement (data on this *is* being gathered, but the program is still new. Furthermore, few concrete ways of measuring the sorts of student gains reported have emerged to date).

Standards:

Maine adopted new state standards for learning in 1998 that include 21st century skills as principles of learning. These Maine Learning Standards are closely aligned with the *21st Century Skills* published by the North Central Regional Educational Laboratory (*enGauge*) and the Partnership for 21st Century Learning. While Maine does not yet assess these standards, visionary state leadership in this area provides incentive for schools to set 21st century learning goals.

Qualified Teachers:

A national focus on highly qualified teachers reemphasizes the critical role that teachers play in student learning. While most states do not specifically mention technology in their definition of a highly qualified teacher, most do include it in their teacher standards. In Maine, prior to the rollout of the one-to-one program, teacher preparation in effective uses of technology was a major focus (thanks in part to a \$1 million Gates Foundation grant). The state eventually funded Regional Integration Mentors (RIMs) as an additional way to ensure integration of the technology into the curriculum through thoughtful, intensive work among and between teachers. This innovative, practical approach has had numerous positive repercussions in terms of increased collaboration and peer mentoring (see the Maine Learns website at: <http://www.mainelearns.org/index.cfm> for more information and for examples of teaching and learning activities).

Noting the difficulty mathematics teachers, in particular, had in effectively using the new technology tools in their content area, the State Department of Education contracted with a mathematics specialist to work full time with math teachers in Maine to develop lessons grounded in research-based technology practices that lead to improvements in student learning.

State and Local Trends:

Pilot Programs:

All schools in Maine now have one-to-one access for 7th and 8th graders as part of *Maine Learns* (also known as the *Maine Learning Technology Initiative* or MLTI). Where district policy, rather than the state's, was a factor was in implementing ubiquitous computing (i.e. prior to the onset of the state legislation, such as in Guilford's SAD #4), those districts became "unofficial pilot sites" for the state.

Scope and Focus:

Three of the four schools interviewed in Maine (Auburn, Piscataquis, and Pembroke) were demonstration sites and have been piloting the laptop program since at least February of 2002. The fourth school (Freeport) has been a participant in the full MLTI program since August of 2002, and just this year (2003-04) added 8th graders to its program.

The decision to extend student access to 24 hours a day, 7 days a week (24x7) through a checkout procedure was left up to local districts. In the first full year of the program, fewer than 50% of Maine districts opted for 24x7 student access. Major deterrents for local districts included: lack of resources for insurance, a lack of confidence in the responsibility of students to care for the machines, and a lack of home Internet access. Nevertheless, the State Department of Education has been working with the private sector to initiate low-cost access to the Internet from Maine homes in an attempt to support the 24x7 model. In the meantime, some districts are working with Apple and Earthlink to provide reduced price service (\$4.95 per month) to their students. Finally, all of the schools are wireless, so kids "camping out" on school steps and in parking lots during evenings and weekends is not uncommon!

PCMS example:

Starting this year (2003-04), 7th and 8th graders are simply assigned laptops for the year, so they can take them home anytime (they return them during the summer to be fixed, cleaned, and loaded with updated software). The district insures the laptops itself by charging according to a fee scale of \$30-50 (depending on SES), which can be paid in installments. They will actually *make* money this way, and that money will be plowed back into the program. Parents can opt out of the district's insurance if they sign an agreement to assume responsibility for the machine(s).

Freeport example:

At the beginning of Year One, Freeport's technology team planned three nights for introducing parents to the MLTI and the iBooks. The importance of one-to-one full time access is a key part of these sessions, which are designed to review student and family responsibilities for at-home use. During these sessions, students demonstrate to their parents how the laptops operate, security functions, programs, and their work to date. Finally, parents also get a chance to use the computers. They are taught how to log on, how to use the toll free number to gain Internet access from home, and how to use basic applications and the Internet browser.

Before a laptop can go home with a student, parent and student must have attended one of the evening sessions and have signed a form indicating they understand the responsibilities for use. The form indicates that the school accepts responsibility for normal wear and tear and damage caused by accidents not resulting from neglect or disregard. In the first year of the program, and out of over one hundred students, only a handful of parents missed all three evenings and only one parent refused to sign the form (she explained that her son could not handle the responsibility at this time, but that she would like to change her mind at some point down the road).

When individual schools and districts were asked if they allowed students to take the computers home, answers varied. Some check the laptops out to students for the year, expecting to refurbish

and upgrade them over the summer, while others allow students to use the technology only for the day. All cited insurance issues as the main reason why students could not take the machines home. Piscataquis Community Middle School, however, came up with a unique solution to the insurance issue, opting to insure the laptops themselves (see sidebar). Parents pay premiums based on a fee scale and installments are an option. It is possible to opt out of this insurance by signing an agreement wherein parents assume responsibility for the machines themselves, but few have gone this route.

Pembroke example:

Pembroke does not send the laptops home at this time, mainly because Debbie Jameson (one of two 7th/8th teachers and a technology resource for the school) hasn't really assigned anything that needs to be done via laptop from home. The district is prepared, however; they now have insurance for the machines, so the kids can take them home if they need to.

Auburn example:

Students at Auburn Middle School do not take their laptops home, but that "*hasn't really been an issue*" so far (teachers are not yet asking for students to do technology-based homework or additional research beyond the school day). If it becomes one, the district will consider revising its policy. For now, they believe the laptops are a good motivator for students to come to school in the morning. The School Committee is, nonetheless, looking into policies to see what insurance needs to be formalized before they can let the laptops go home. They expect to do some parent training before this happens as well.

Technology:

Maine let a Request for Proposal (RFP) in the fall of 2002 identify a single vendor as the provider of the state's wireless technology solutions. Initially, there was speculation that the solution would be a Web appliance, since a Maine company distributed such devices. But in the end, the Maine Department of Education signed a 4-year, \$37.2 million contract with Apple Computer for iBooks and wireless networks in all 7th and 8th grade classes.

PCMS example:

Prior to laptops (even before the state's program), Piscataquis Community Middle School had computer labs and desktops in all of their classrooms, and there was a computer applications class taught in one of the labs. Early thinking was that they would go with Palm Pilots, but Crystal Priest, the District Technology Coordinator, says they thought that might limit what the students and teachers could do. Now that their laptop program is in full swing, they're glad they went with the more versatile machines, and not just because the state ended up going that way as well.

According to state policymakers, the decision to use Apple was predicated on a combination of the reliability and functionality of the iBook, coupled with a similarity of philosophy between the state and the company. Maine is known for its rugged individualism and local control; Apple's products and services focus on the ease of using of a highly versatile computer to meet individual needs.

In addition to the computers and network infrastructure provided by the state, districts and schools – depending on their individual budgets – are free to expand their programs, and many have. Auburn Middle School, for example, has purchased Microsoft Word (along with numerous school-wide peripherals) for each of its 300 7th grade laptops. Other schools/districts purchase carts, projectors, digital cameras, printers, probes, and more to enhance the technology the state provides.

3. What do Maine’s policymakers expect will be the outcomes of their state’s ubiquitous computing initiative? Are these expectations the same as or different from those of educators? How are they aligned to Maine’s overall education agenda?

Expectations:

Policymakers and educators in Maine, when asked about their expectations for the state’s ubiquitous computing initiative, offered surprisingly similar views:

<i>Expectations of Maine Policymakers</i>	<i>Expectations of Maine Educators</i>
<ul style="list-style-type: none"> ➤ <i>Increased economic viability of the state, including:</i> <ul style="list-style-type: none"> ▪ Increased breadth and depth of Maine’s high-tech workforce ▪ Increased educational attainment among Maine students ▪ Increased retention of Maine graduates in Maine jobs ▪ Increased recruitment of graduates from other states into Maine jobs ➤ <i>Increased student engagement in learning (e.g., increased attendance, decreased behavioral referrals, teacher reports of increased time on task)</i> ➤ <i>Improved technology literacy and other 21st century skills</i> ➤ <i>Decreased digital divide</i> 	<ul style="list-style-type: none"> ➤ <i>Increased economic viability for individuals and for the state</i> ➤ <i>Increased student engagement, better attendance, and increased time on task across all student populations</i> ➤ <i>Improved student achievement that is more in line with 21st century skills (esp. real-world relevance, higher-order thinking and problem solving, information and technology literacy, and effective communication)</i> ➤ <i>Improved teaching, including:</i> <ul style="list-style-type: none"> ▪ Increased technology proficiency ▪ Better curricular design and technology integration ▪ Greater use of a variety of resources ▪ Improved teacher attitudes ▪ A more facilitative style of instruction

Educators in Maine were asked not only to reveal their own expectations; they were also asked if they thought the expectations of policymakers were similar to or different from their own. District interviewees across the state responded as follows:

“Our expectations are very similar – especially the Governor’s idea of transformational versus incremental change.”

“I think the legislators that were pushing the program had the same expectations: learner-centered teaching, improved teaching and learning overall, student ownership, and student engagement.”

“Their expectations are same as ours, and they face the same sorts of opposition points.”

It is important to note, however, that despite the similarity of expectations between educators and policymakers in Maine, there is a sense among educators that actually *measuring* gains in these areas may become a point of contention. *“Policymakers want better attendance, better MEA scores, fewer behavior issues – all things that can be measured,”* says Mike Shannon, a Regional Integration Mentor and teacher at Auburn Middle School. *“But I don’t think that’s where we’re going to see the major changes.”* Furthermore, say Shannon and other educators, it will be difficult to measure the changes they *do* see (for more on this, see the Assessment and Impact sections below).

Fit Within the Educational Agenda:

Significance:

Every one of the four schools interviewed – and every person represented in each district, from the Superintendent to the building level tech coordinator – reported that the Maine Learns laptop program is the most significant initiative to date, both in scope and in terms of teaching and learning gains.

Freeport example:

“This is the first truly successful innovation I’ve seen in more than 23 years as an educator,” says Chris Toy, Freeport Middle School’s principal.

PCMS example:

The ubiquitous computing program at SAD #4 *“is the central hub of our entire educational philosophy,”* says Matthew Oliver, Superintendent. *“Students of this generation – this is their medium.”*

Crystal Priest, SAD #4’s District Technology Coordinator, agrees. But just as critical as the laptops is the wireless technology: *“that’s what moves the computer into the middle of the room instead of keeping it in the back.”* And of course, she notes, effective integration is vital as well.

Auburn example:

The ubiquitous computing program at the Auburn School Department *“is the most significant education technology initiative we’ve undertaken in terms of its impact on teaching and learning,”* says Barbara Eretzian, Superintendent.

Kathleen Cutler, principal of Auburn Middle School, was equally *“blown away”* by watching the first students and teachers use their laptops. *“I instantly became a convert,”* she says, wishing everyone could come and spend time at the school to see how well the machines fit with their mission (they’ve invited several legislators, but none have visited).

Pembroke example:

“This initiative is extremely significant,” says principal Paula Smith. *“I could easily see that this was an opportunity these kids would never have had otherwise.”*

School Improvement:

Ubiquitous computing seems to be part of a larger school improvement trend across the state of Maine. All of the school and district personnel interviewed spoke of improvements in teaching and learning as something already in the works, as evidenced by the Maine Learning Standards. One-to-one technology is seen as an important tool for advancing this trend.

Critical Factors:

Across the state, school and district interviewees cited three factors that were absolutely critical for the effective implementation of one-to-one programs:

- Strong, visionary leadership that encourages and supports risk-taking
- Upfront and ongoing professional development that includes sufficient time, resources, and support for developing teacher technology proficiency and effectively integrating technology into the curriculum
- A quality infrastructure that is in place and well supported

Freeport example:

“The first key to success of the MLTI is an effective team of talented and enthusiastic teachers,” says principal Chris Toy. “The second key is leadership with vision and the willingness to support [that team] to take risks in a quest to attain the vision.”

Auburn example:

Mike Shannon, Regional Integration Mentor and the building-level technology coordinator at Auburn Middle School, believes it’s important to encourage teachers to become familiar with the laptops before they are used in class. *“Give teachers laptops on the last day of the school year, and then give them tasks and training over the summer,”* he says. *“Where they are resistant is letting go, but building proficiency helps. Still, teaching doesn’t always equal learning, so integration is just as important. And you’ve also got to be prepared to provide time and training during the school year for ‘in-flight corrections.’”*

Assessment:

One of the state evaluators for the Maine laptop initiative, Dr. David Silvernail of the University of Southern Maine, has been documenting preliminary changes in teaching and learning as evidence of the program’s success. Pilot and first year anecdotes suggest that, in some schools, the laptops are resulting in students learning more quickly and at deeper levels: they are *“seeing the connections.”* This is in part due to increased teacher collaboration across disciplines following the rollout of the one-to-one initiative.

Despite the positive anecdotal evidence he’s seen, however, Silvernail laments the late start Maine got in collecting baseline data and more formally tracking the impact of the program on student learning. He concedes that the real story of the initiative’s impact will be told through long-term research studies rather than quick snapshots of school practices and surveys of teachers and administrators, though it should be noted that these have been sufficient for convincing many stakeholders to date. With the recent award of a grant to the state for long-term impact studies, this more formal work will begin in Maine soon.

Metrics:

Few schools or districts in Maine have developed new metrics to measure the gains they see, though they recognize the need to make such gains relevant in a way that others – especially policymakers and potential funding sources – can understand. There is some preliminary evidence of student achievement gains as measured by the Maine Educational Assessment (MEA), especially in reading, writing, and math, but these gains have yet to be more formally linked to ubiquitous computing. In some cases where a one-to-one program has been in place longer than the statewide program has, such as at Piscataquis Community Middle School, a third party evaluation to address this is underway. However, most schools and districts continue to rely on anecdotal evidence and the statewide evaluation.

PCMS example:

Based on a longitudinal survey of 7th and 8th grade students in the district (spanning the time that students had 3:1 access to the period they had 1:1 access), the district saw a 54% drop in behavior letters sent home, a 7.7% increase in attendance, a 5% increase in language arts scores (MEA), a 8.4% increase in math scores (MEA); and a 9.2% increase in science scores (MEA). Though the district did not control this study to identify whether or not these gains were directly attributable to the increased access, they believe that the results are telling.

It is a point of pride that this district (SAD #4) has the second lowest per-pupil expenditure in the state, yet it currently provides all students in grades 6 through 12 with 24x7 access to Internet-connected laptops. Furthermore, the 12th grade students in the district (who have now been using laptops during all four years of high school), scored higher than 85% of their peers in the state in all five core subjects of the last MEA assessment. In addition, the Class of 2003 saw an all-time high percentage of students going on to college.

Auburn example:

In 2001, 8th grade MEA scores at Auburn Middle School were slightly below the state average for students meeting or exceeding state standards. However, the language arts scores in reading and writing changed fairly substantially for the November 2002 test (10% more students now meet or exceed the standards in writing; 6% more do in reading). Since the laptops were initially deployed in February of 2002 to identifiable teams of students, Kathleen Cutler, the school's principal, is attempting to separate out the scores for students who had been using laptops prior to the test (those students account for 1/3 of the now 8th grade class that saw such a jump in their MEA scores). While she acknowledges that this may not be the most scientific approach to evidence gathering, she does see the attempt as valuable. *"We do observations,"* she says, *"and we can see the connections to improvements. But we don't have the time or the resources to do full-scale, validated studies."* Nonetheless, Cutler insists on collecting data wherever she can. For example, she surveyed the students who received the initial laptops to ask what they are doing differently because of the machines, an exercise that resulted in a good deal of positive – albeit self-reported – evidence (e.g., *"I was failing, but now I'm doing well because I like school more"*).

Freeport example:

Perhaps because Freeport Middle School students consistently score above state average on math and reading assessments, Chris Toy likes to talk about less measurable gains that have resulted from the school's implementation of one-to-one computing. He tells how Stephen King recently visited Freeport to talk about writing – an area where the school's students are not so exemplary. King described how becoming a computer user had led to his discovering the Internet, and he shared his belief that the Internet opens up great possibilities for people to communicate about writing. Then he offered to work with the students via an online course.

“Certainly the opportunity to work with Stephen King is a benefit well beyond anything anyone could have predicted a year ago, [yet it is] just the kind of unforeseen advantage that the MLTI can provide to our students,” says Toy. And there are others. “This project has caused companies like Apple Computer to invest resources well in excess of the contracted amount of money they are being paid for hardware and wireless networking. It has attracted nonprofit groups like the Bill and Melinda Gates Foundation to provide significant monetary support for training teachers and school leaders around technology. Most satisfying of all, these students will grow up with the knowledge that they were trailblazers – the first large-scale group in the nation to use this new tool for learning.”

Technology Literacy:

Technology literacy is measured in the 8th grade by the state and by some districts in Maine, but the measures (often checklists) are generally viewed as fairly rudimentary (and superfluous). One superintendent suggested that 5th grade students could easily pass the state tests, but acknowledged that the measures are sufficient for meeting NCLB requirements.

4. What funding mechanisms support ubiquitous computing in Maine?**Funding:**

With the downturn of the economy corresponding with the inability of state leaders to push effectively for the establishment of the Learning Technology Endowment (resulting in the expenditure of hard currency up front), the sustainability of the Maine Laptop Initiative was at risk after its first year. But because the interim data from the state's evaluators showed remarkable promise, state policymakers elected to continue funding the initiative into its second year, providing a new wave of 7th graders with laptops (and allowing those going on to 8th grade to continue their one-to-one access). The initial success also brought backing from local schools and communities, lending the grassroots support needed to pressure the Legislature into keeping the funding flowing.

Direct and Indirect Costs:

No one interviewed at the school and district levels reported that they'd been surprised by unexpected costs attributable to laptop implementation, though everyone would like to have more money to hire additional technical support personnel. Still, the general sentiment was that the state and Apple were doing a good job of assuming "responsibility for the management piece" of the one-to-one initiative.

In most cases, it is local policymakers (such as School Board members) who guide decisions about spending additional monies beyond what is provided by the state. Areas of need included paper, peripherals, and software to extend the relevance and capabilities of the technology. Most districts have met these needs by writing grants and establishing partnerships with local businesses, and many are looking to those sources to expand their laptop programs to the high school level.

Sustainability:

Every single person interviewed at the district and school level plans to continue – and if they can expand – one-to-one access. "Kids are at a loss when they don't have access to technology," says PCMS Teacher Leader Robyn Rich. She thinks this is going to be a major issue for the state and for districts. "When the kids hit the high schools, they're going to be very used to working on computers and using all of the resources that go with them."

Most of the educators and administrators interviewed hope the state gets pressured to roll out the program to the high schools. At the same time, they suggest that they'll find a way to expand their programs at the district level even if the state doesn't come through. "I don't see how we can't figure out how to afford it," asserts Freeport principal Chris Toy. Paula Smith, principal of Pembroke Elementary, a tiny, rural, and very low SES (socioeconomic status) school, was asked what she would do if the funding for the program dried up. "I'd mortgage my house," she responded. "This program is that important."

Freeport example:

One unexpected cost in Freeport was the extra workload on the school's tech support personnel. "The program added at least two additional weeks of work to our Coordinator's summer hours. Fortunately [he] has a personal interest in seeing the MLTI implemented successfully and seems to be willing to put in whatever it takes to make it work. We are also fortunate to have the support of the superintendent and the school committee, who were willing to provide additional resources to support the extra hours needed."

PCMS example:

Since part of their professional development is paid for through a Gates Foundation Grant (and the rest through the MLTI), SAD #4 and PCMS have not yet encountered any unanticipated costs. The issue of sustainability is currently being considered by the Board; the Superintendent wants to set aside 3% of operating budget every year and expects that the Board will be amenable thanks to the positive changes they've seen. (This is a strategy that seems to work well in Henrico County, Virginia.)

Auburn example:

The Auburn Board has been very supportive regarding the occasional tradeoffs required to keep this initiative fully funded – again because they've seen positive results. Peripherals (digital cameras, probes), software (Microsoft Word), and paper might be unexpected costs for some districts, but they were absorbed into the regular budget by the Auburn School Department.

5. What is the impact of ubiquitous computing on local school policies in Maine?

School Policy Shifts:

To date, the only formalized policy shifts at the local level in Maine have come in two forms: Acceptable use policies for students, and adjusted professional development policies for teachers. For the most part, the curriculum has not been formally redesigned: it has always been aligned to the Maine Learning Standards, which are seen as progressive and reflective of the 21st century skills and proficiencies today's students need to develop. Among these participating schools and districts, one-to-one technology is seen – and used – as a tool to enhance teaching and learning.

PCMS example:

Perhaps the only unique policy change at SAD #4 that accompanied the laptop initiative from the start was the district's issuance of an "Internet Driver's License." Students receive these as a de facto statement of understanding regarding responsible use; they may be revoked by the school or district on a case-by-case basis and at any time.

Local Impact:

Specific Subjects:

All of the educators interviewed reported positive impacts across subjects, but where specifics were given, most said that science, math, and writing especially benefited from one-to-one access.

Freeport example:

In a recent math class at Freeport Middle School, students were using "Chipmunk Basic" to create simple programs to help them practice basic math facts. *"It was amusing to see the students compete with one another and themselves to see how quickly they could solve a given number of problems in the fastest time. When they mastered a certain level, they rewrote their programs, making them more difficult. I don't think I've ever seen students so focused on learning basic math facts."*

Pembroke example:

In all subjects, says Paula Smith, *"these kids have improved by leaps and bounds"* as a result of the laptop initiative. School and district administrators have seen – and heard about from students – exponential increases in student engagement, and their teachers are delighted with their new access to a much richer curriculum. Student products are more meaningful and authentic, even those completed via distance education. Tiny, rural Pembroke is now first in the state in the Maine Stock Market simulation program, and second in the nation. They have produced their latest yearbook entirely electronically – pictures and all. In addition, the school's latest MEA scores have gone up; student scores on the state writing assessment have risen by an average of 10 points since the laptops were handed out.

Specific Student Populations:

Three of the four schools (Auburn, Freeport, and PCMS) pointed to special education and learning disabled students as populations that benefit most from the one-to-one access. *“Students who could not sit and listen to the teacher or their classmates were able to use the computer to organize, write, and do research, sometimes for an hour or more at a stretch.”* Furthermore, this technology removes the stigma of being different, because laptops can be customized to accommodate student needs without changing their outward appearance. And because of the ubiquity of the technology, *“kids can’t hide anymore, so it’s easier to see who needs more help and who’s falling through the cracks.”*

Educators at Pembroke Middle School suggest that, while all students certainly benefit, the *“quiet and unmotivated”* ones see the greatest gains. *“They just needed a trigger, and this is definitely it.”*

Kathleen Cutler, principal of Auburn Middle School, also points to the *“kinesthetic and visual needs”* of middle school-aged students. She suggests that the laptops are a great way to tap in to those needs to enhance learning and achievement across the board.

Change Processes:

All respondents at the local level in Maine suggested that technology both drives change and is a lever for it. This sentiment is perhaps most succinctly stated by Kathleen Cutler, principal of Auburn Middle School: *“No one thing drives it all. Lots of things are coming together. Technology is not necessarily the driving force, but it’s the propeller on the engine.”*

PCMS example:

In terms of teaching and learning, says Superintendent Matthew Oliver, there is *“no question; this was a big change... Teachers are becoming more facilitative: less the ‘sage on the stage’ and more ‘guide on the side.’”* Though the initial teacher response in the district was a mix of fear and excitement (most had been teaching for more than 15 years and didn’t know a lot about technology), teachers have been supported by school and district leaders and encouraged to learn – even from their students. Changes have also been made in staff development to demonstrate for teachers various tools and techniques for integration, including those that are subject-specific (e.g., they learn to use My Access for writing and probeware for science). *“Nowadays, what you need is right there on your desk. I don’t need to wait until next Thursday to go to the library and start a lesson using technology,”* says Robyn Rich, PCMS Teacher Leader. Even those teachers who were initially reluctant are enjoying widespread access to on-demand resources, and that shows in their teaching, say school officials.

Auburn example:

The MLTI program has really been a motivator for changes already underway in the Auburn School Department. At the same time, *“it’s lit a fire at the middle school.”* As a result of the program, there is a lot more data sharing among staff and a lot more engagement among students.

Educators at Auburn have seen numerous student gains, not least of which involve less measurable gains like behavioral improvements. *“Kids are just more engaged and well-behaved; they’re connected to their classrooms and to their tasks. You see it when you walk around the school.”* A lot of business people have visited the school to observe those changes first hand. State legislators have also been invited, but none have accepted the invitation, *“which is unfortunate.”*

Professional Development:

Educators throughout Maine cited both the need for and the value of comprehensive, up-front, *and* just-in-time professional development to ensure the success of one-to-one. Various strategies, developed at the district level, were used to meet these needs.

Robyn Rich, PCMS Teacher Leader, confirms that good support and good leadership make a big difference to teachers. When they aren't heavily pressured – and therefore afraid they'll fail – teachers feel free to learn and explore. This is true at PCMS and elsewhere. *"In other schools, there was a lot of skepticism from teachers before they got the machines. But once they got them and started to experiment, they came around quickly. Now a lot of the resistance is going away. This is a natural evolution in teaching, and most people see that."*

PCMS example:

"You need continuous staff development for effective implementation," acknowledges Matthew Oliver, the Superintendent of SAD #4. Though teachers are evaluated for their technology competency as part of their performance reviews, the district is committed to *"building capacity"* rather than forcing technology down teachers' throats. Educators in the district take pride in their culture of collaboration, and district leadership encourages peer mentoring. In addition, teachers earn Continuing Education credits for attending after-school workshops.

Auburn example:

Even prior to the MLTI pilot, Auburn had partnered with the University of Maine through their professional development intern program. Consequently, they have student teachers in the middle school building all the time – a fact that had already brought in significant technology-related money for staff development. The school continues to conduct numerous workshops, many of them dedicated to technology use and integration, and they provide incentives like reimbursement for coursework and traded days off for summer workshop attendance. MLTI sponsors a workshop at the school as well, and it helps that Mike Shannon is a Regional Integration Mentor. Still, district personnel would like to hire someone just to be in the classrooms with teachers for just-in-time and on-the-spot training.

Freeport example:

Once a month at Freeport, students are released two hours early to give teachers time for professional development. During the first full year of the MLTI initiative, Chris Toy and John Lunt, his technology coordinator, used that time and all available staff development resources to prepare and support the teachers involved in the laptop program. They also simultaneously trained the 8th grade teachers who would be using laptops with students the following year – partly through "potlatch" sessions where 7th grade teachers were asked to share their experiences.

PCMS example:

There is a feeling at SAD #4 that state-level policymakers need the “bean-counter data,” but the district doesn’t worry too much about that for their own purposes. In fact, they think the state is asking the wrong questions: *“You can’t run this like any old other project, but they’re trying to.” “There are times when the state program and the way it’s run are very frustrating compared to the local initiative.”* On the other hand, with the initiative going statewide, there are also benefits, like the greatly increased collaboration between schools, districts, and educators.

Pembroke example:

At Pembroke Middle School, as in the other schools and districts interviewed, there is a sense that the traditional measures of success are inadequate. Policymakers, say Paula Smith and Debbie Jameson, really need to visit to see first hand how well the program is working, because the results are far greater than those which can be quantitatively measured.

Auburn example:

Kathleen Cutler, Auburn Middle School’s principal, suspects that her students’ increasing MEA scores are attributable to the engagement fostered by the laptop program. She’s struggling to find a way to prove that, though, especially since she believes that *“it’s the kind of data policymakers want to see.”* Again, though, there is a sense that policymakers are asking the wrong questions.

Cutler and others are not opposed to having a state test – even a new one that would more likely measure the impact of the laptops – but they insist that so many of the positive changes (like time on task) can’t be identified that way. *“They’re just always going to be anecdotal,”* says Cutler. Essentially, she is looking for a win-win situation: she’d like to see test scores go up so the state people get what they’re looking for, and she’d also like the legislators *“to walk into my classrooms and see this program in action. You just can’t envision this until you see it.”*

Local Opinion: How Maine Should Measure Success:

Each of the educators and administrators interviewed repeatedly said they’d like state-level policymakers to visit, to see firsthand what one-to-one means to the daily work of their students and teachers. Business leaders have gone out to schools and agree, but few policymakers have accepted such invitations. Said one superintendent, *“The evidence is there; it just takes time. We need to be looking at qualitative changes, not just quantitative ones.”*

State Response:

At this juncture, the Maine Department of Education is focusing on interim progress indicators such as equity, quality of implementation, student engagement, and graduation rates. The state is working toward the use of portfolios as an assessment tool (contingent upon federal approval for use in calculating Adequate Yearly Progress or AYP). This would provide a richer context for looking at the 21st Century learning in Maine.

In addition, the state of Maine has recently received a substantial federal grant from the U.S. Department of Education to conduct a longitudinal study on the impact of quality professional development on student learning through wireless, ubiquitous computing.

6. What were the unintended consequences, negative and positive, of the laptop initiative in Maine?

The Good:

According to the educators interviewed for this study, three major surprises have been the result of the Maine Learns one-to-one initiative thus far:

- Students are becoming respectful, responsible “ambassadors” of the program
- Teacher skepticism is down – and retention is up
- Parent-student communication is improving

Students are becoming respectful, responsible “ambassadors”

Despite the thinking behind some of the opposition to one-to-one initiatives, it isn’t the students who struggle to adapt to such a starkly new learning environment. After all, they’re “natives” to the Digital Age. Yet most of the administrators and educators interviewed were surprised by *“the ownership, respect, and responsibility demonstrated by students of this age.”* Not Freeport principal Chris Toy. *“From the very first discussions when concerns about students taking care of computers was brought up as a reason to abandon the idea, I felt it was an unfair characterization of their ability to take on responsibility. The students have been great ambassadors for the program. They have helped one another, their teachers, and their parents with the introduction of the new laptops. They have, in many cases, become the teachers. Talk about transforming the role of teaching and learning!”* In addition, each of the schools and districts interviewed reported few incidents of loss or damage that resulted from student neglect.

Teacher skepticism is down – and retention is up

In general, it is teachers – like many adults – who need a bit more convincing that one-to-one is a good idea. Yet a second unexpected outcome of the Maine laptop program has been its impact on teacher attitude and retention. *“This has brought teachers together like nothing before,”* says Mike Shannon, Regional Integration Mentor and building technology coordinator at Auburn Middle School. *“And I don’t even think they know it yet.”* He can point to numerous collaborative and serendipitous discoveries teachers have made of ways to take advantage of the technology for improved teaching and learning. With little exception, there is a sense across the state that this will continue. *“People are linking up. No one’s talking about that as a positive outcome yet, but it really is.”*

At the end of the MLTI program’s demonstration year, Chris Toy and his technology coordinator John Lunt attended a meeting sponsored by a consortium of schools in the southern part of the state to get a feel for what he should expect. *“One Teacher Leader was amazed at how this initiative has rejuvenated some veteran teachers. A teacher who had previously been talking about retiring in the face of the arrival of the new computers is suddenly energized and learning everything he can about web quests, page design, iMovies, and search engines. Just last week, this almost-out-the-door teacher announced proudly to the teacher leader that he had sent his first email ever. I think if things continue along these lines – and as long as the public knows about these success stories – the next battle to protect funding for technology may be the last.”*

These participants agree: *“This kind of program benefits more than the kids. We’ve seen staff completely turn around. It breathes new life into them – and not just the young ones!”*

Parent-student communication is improving

Last – though certainly not least – several of the educators interviewed indicated that parent-student interaction has improved significantly as a result of the laptop program. Said one, *“Parents say their kids used to just grunt at them when they asked about their day. Now they won’t stop talking about what they’re doing in school and with the technology!”*

Remaining Challenges:

In addition to the positive “unexpecteds” they reported above, educators in Maine found the following to be areas in need of improvement:

- Excess burden on technical support personnel
- Faulty and/or out-dated wiring in older school buildings
- Insufficient inclusion of key stakeholders

Auburn example:

“We don’t have enough people to keep the laptops going all the time, so tech support is strained and people are spread thin.” The district is looking to hire on to their technology staff, if funding permits.

In addition, because their buildings were old, they had initial wiring issues, and this will be a problem they now know to look out for (and fund) at the high school. Finally, *“The management piece has its challenges, but Apple has been great.”*

Freeport example:

According to Chris Toy, *“the decision by the managers of the project to exclude computer coordinators and school librarians from receiving laptops kept some of them from lending their full support to the implementation. This was not the case in most systems, but it was true in some.”*

In addition (as mentioned above), the extra workload the program imposed upon the school’s technology support personnel *“added at least two additional weeks of work to our coordinator’s summer hours. Fortunately, [he] has a personal interest in seeing the MLTI implemented successfully and seems to be willing to put in whatever it takes to make it work. We are also fortunate to have the support of the superintendent and the school committee, who were willing to provide additional resources to support the extra hours needed. Many school systems are not as fortunate.”*

7. What are the next steps for Maine?

Next Steps:

In general, schools and districts across the state of Maine report a strong desire to continue to support and sustain their laptop programs, with many seeking alternate funding sources to finance expansion. Key to these endeavors is an enhanced connection with the community, with business and industry, and with other schools and districts. Some – like Pembroke – are joining area consortia to raise money collectively, often through grant writing. Others – such as PCMS – are seeking ways to make student work more meaningful to their local community and area businesses. Still others are working with Apple Computer on a more individualized basis to scale up their programs to 9th-12th grades. For their part, MLTI Regional Integration Mentors are bringing teachers together from across the state to present lesson plans, and are in the process of developing a book in order to provide everyone access to others' "recipes" for success.

In terms of expanding the existing program, *"I can't imagine kids suddenly reverting to old ways of learning,"* says Auburn Middle School principal Kathleen Cutler. Like the other schools and districts interviewed, she would like the state to tackle this issue, but with the support of the Superintendent and her Board, Cutler insists that, *"Auburn is talking about how we're going to fund this regardless of what the state does."* Other districts appear to be seeking ways to follow suit.

Advice to Other Educators:

State Level:

State level interviewees offered the following "words of wisdom" to others contemplating one-to-one programs:

"While a focus on the impact on learning is important, do not overlook the fact that such an intensive high-tech initiative will require strong support from the IT (Information Technology) side of the house. Ensure their support by involving that group from the beginning."

"Invest in up-front planning for evaluation and research. It is important to understand clearly the expected outcomes and to collect baseline data early."

"Provide laptops, not only for teachers, but for all educators involved in instructional programs, especially library media specialists."

Local Level:

At local school and district levels, the advice to other educators in Maine and elsewhere was:

“Anticipating the future, having a vision of where things will be in the future, and moving in that direction has a whole lot to do with success.”

“Go to a district that’s done it; don’t try to write the whole playbook by yourself.”

“You’ve got to have a sense of humor.”

“‘Survival of the fittest’ doesn’t mean survival of the biggest or the baddest. The fittest are those most adaptable to change.”

“Don’t be afraid that the kids are ahead of you – that means it’s working.”

“I can’t imagine that school systems wouldn’t do this. This is where it’s going. It’s the way of the world.”

“Teacher buy-in is critical. Make sure you have people to support the teachers with the technology...don’t even start this unless you’re going to support it.”

“There are times to use the computer and there are times when it doesn’t make sense. Teachers need to make good decisions about when the laptops are a useful tool and when they are just fancy bells and whistles.”

“The medium of this generation is video and multimedia communication. I wonder how long it will be before we are all be able to do what the Spielbergs and Lucases do. Judging by the student work so far, it won’t take long.”

“This is a way to change teaching and learning in schools to match the way it happens in the real world.”

“Go for it!”

While the jury is officially still out in terms of the impact ubiquitous computing has had on learning and economic viability, it seems clear that in Maine middle schools the digital divide is closing and the laptops are here to stay.